NASA Procedural Requirements

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COMPLIANCE IS MANDATORY

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Subject: Systems Engineering Procedural Requirements

Responsible Office: Office of the Chief Engineer

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Chapter 5. Systems Engineering Technical Reviews

5.1 Life Cycle

5.1.1 NASA has four interrelated product lines as defined by 7120.5: Basic and Applied Research (BAR); Advanced Technology Development (ATD); Flight System and Ground Support (FS GS) projects; and Institutional Projects (IP). As shown in Figure 5-1, each product line has its own unique product-line life cycle. Figure 5-1 shows the product-line life cycles and technical reviews mapped into the management life cycle.

5.1.2 The product-line life cycle for a typical BAR project begins in the "Preparation of Portfolio" phase and eventually ends with a "Monitor Performance Metrics" phase.

5.1.3 The ATD management life cycle for a typical ATD project begins in the "Concept Study" phase and eventually ends with "Technology Readiness Level Maturation" and "Key Performance Parameters (KPP) Enhancements" phases.

5.1.4 The FS GS project management life cycle starts with "Concept Studies," progresses into a "Concept Development" phase, and eventually ends after its "Operations and Sustainment" phase with a "Disposal" phase.

5.1.5 The IP management life cycle proceeds through their capital assets life cycle in five well-defined phases. An IP project starts with a "Pre-Formulation and Proposal" phase, progresses into a "Preliminary Design" phase, and eventually ends after "Operations and Maintenance" with a "Disposal" phase. For non-capital asset projects, the last three phases are replaced by an "Execute Project Plan" phase. Typically, these projects enable all of the other NASA investment areas and product lines.

5.1.6 The two major common phases for all of the product linesare Formulationand Implementation. Within each product line, the specific phases are appropriate to their product lines. FSGS projects have two variations-traditional flight systems development and Announcement of Opportunity (AO) projects.

5.1.7 The life-cycle phases in which the SE engine is applied and the technical reviews of this chapter are closely linked to the management life-cycle phases of NPR 7120.5. The application of the common technical processes within each life-cycle phase produce technical results that provide inputs to technical reviews and support informed management decisions for progressing to the next product-line life-cycle phase.

5.1.8 At each management decision gate, one of the key questions is whether the project is ready to proceed to the next product-line phase (i.e., from Phase B to Phase C). At each decision gate, management examines the maturity of the technical aspects of the project; for example, whether the resources (staffing, funding) are sufficient for the planned technical effort, whether the technical maturity has evolved, what the technical and non-technical internal issues and risks are; or whether the stakeholder expectations have changed. If the technical and management aspects of the project are satisfactory and corrective actions are implementable, then the project can be approved to proceed to the next phase.

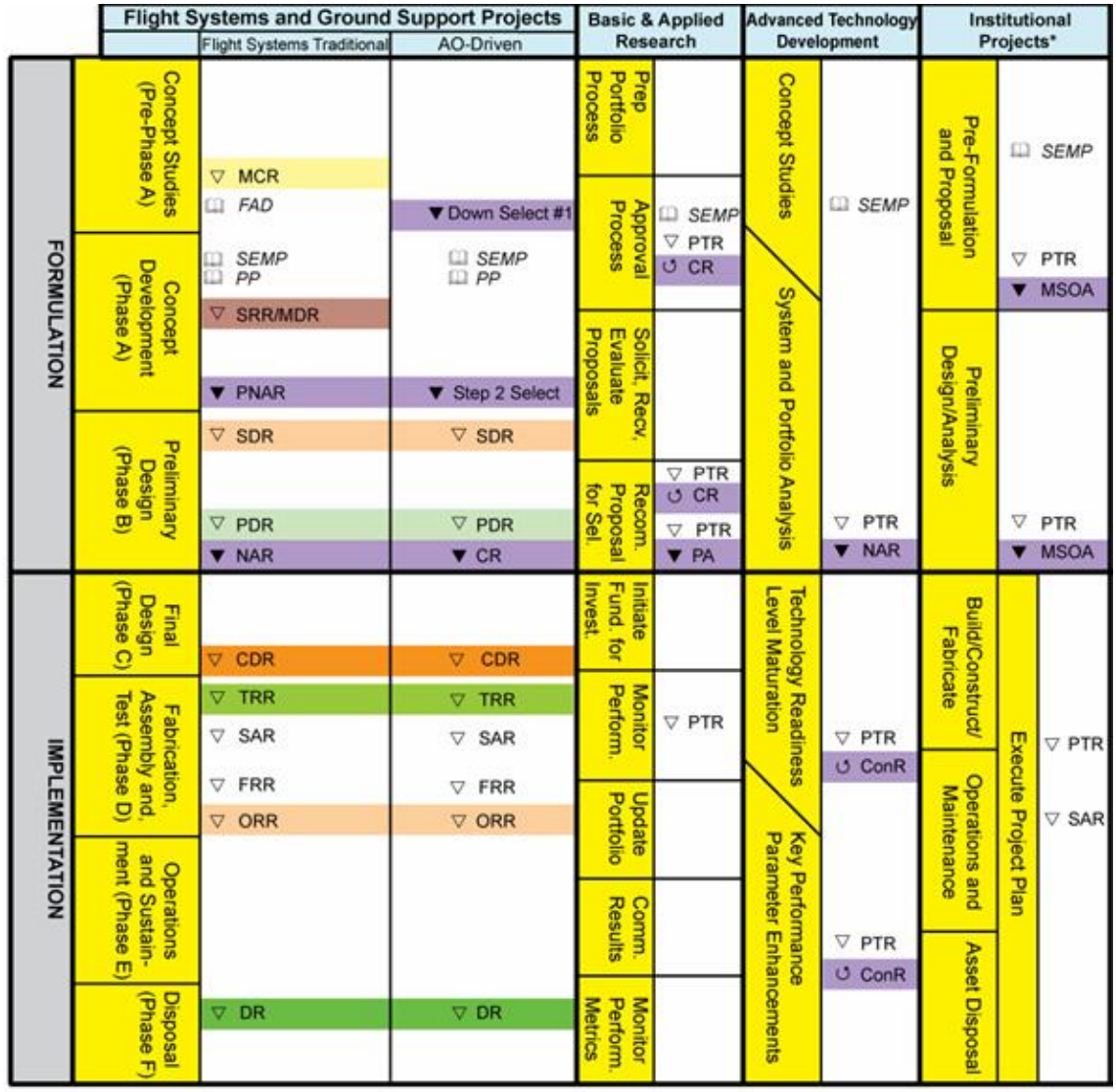

Figure 5-1 - Product Line Life Cycle

5.1.9 Three points are important: (1) Management reviews and the technical reviews support one another. (2) Technical reviews are completed before a management decision gate. (3) Technical reviews should occur relative to the maturity of the relevant technical baseline as opposed to calendar milestones (e.g., the quarterly progress review, the yearly summary, etc.).

5.2 Technical Review Requirements

5.2.1 Review Process and Practices

5.2.1.1 For each product line (BAR, ATD, IP, and FS GS), technical efforts are monitored throughout the life cycle to ensure that the technical goals of the project are being achieved and that the technical direction of the project is appropriate.

5.2.1.2 Technical teams shall monitor technical effort through periodic technical reviews. (See Technical Assessment Process Appendix C.3.7.4.d.)

5.2.1.3 A technical review is an evaluation of the project, or element thereof, by a knowledgeable group for the purposes of:

a. Assessing the status of and progress toward accomplishing the planned activities.

b. Validating the technical tradeoffs explored and design solutions proposed.

c. Identifying technical weaknesses or marginal design and potential problems (risks) and recommending improvements and corrective actions.

d. Making judgments on the activities' readiness for the follow-on events including additional future evaluation milestones to improve the likelihood of a successful outcome.

e. Making assessments and recommendations to the project team, Center, and Agency management.

f. Providing a historical record that can be referenced of decisions that were made during these formal reviews.

5.2.1.4 See NPR 7120.5 for a description of independent reviews, major reviews, project milestone reviews, and engineering peer reviews.

5.2.1.5 The set of minimum reviews is used to evaluate the status of the technical progress and is supported by other equivalent technical discipline activities to include safety reviews.

5.2.1.6 The technical team shall ensure that system aspects represented or implemented in software are included in all technical reviews to demonstrate that project technical goals and progress are being achieved and that all NPR 7150.2 software review requirements are implemented.

5.2.2 Planning and Conduct

The technical team shall develop and document plans for technical reviews for use in the project planning process. The technical review schedule will be reflected in the overall project plan described in NPR 7120.5. The results of each technical review will be used to update the technical review plan as part of the SEMP update process. The review plans, data, and results should be maintained and dispositioned as Federal records.

5.3 Minimum Set of Technical Reviews

5.3.1 Definition of Minimum Set

5.3.1.1 Figure 5-1 maps specific reviews and their time sequence for each product line. These reviews are event based, held prior to management reviews when progressing from one life-cycle phase to the next. A description and representative entrance and success criteria for each of these reviews are contained in Appendix G. Additional description of technical reviews is provided in NASA Systems Engineering Handbook (SP-6105).

5.3.1.2 The monitoring function for traditional FS GS projects shall be accomplished using the following required minimum set of technical reviews: Mission Concept Review (MCR) , System Requirements Review (SRR) and/or Mission Definition Review (MDR), System Definition Review (SDR), Preliminary Design Review (PDR), Critical Design Review (CDR), Test Readiness Review (TRR), System Acceptance Review (SAR), Flight Readiness Review (FRR), Operational Readiness Review (ORR), and Decommissioning Review (DR). Programs would typically hold FRR, ORR, and DRs with support as required from the projects.

5.3.1.3 The assigned technical team shall accomplish the monitoring function for flight-related ATD projects using appropriately defined and conducted periodic technical reviews (PTR).

5.3.1.4 The assigned technical team shall accomplish the monitoring function for IPs using PTRand SAR.

5.3.1.5 SP 6105, NASA Systems Engineering Handbook, provides a complete description of additional common technical progress reviews (interim reviews) with entrance and success criteria, as well as timing, key products, success criteria, etc.

5.3.1.6 Reviews are considered complete when the following is accomplished:

a. Agreement exists for the disposition of all Review Item Discrepancies (RID) and Request for Actions (RFA).

b. The review board report and minutes are complete and distributed.

c. Agreement exists on a plan to address the issues and concerns in the review board's report.

d. Agreement exists on a plan for addressing the actions identified out of the review.

e. Liens against the review results are closed, or an adequate and timely plan exists for their closure.

f. Differences of opinion between the project under review and the review board(s) have been resolved, or a timely plan exists to resolve the issues.

g. A report is given by the review board chairperson to the appropriate management and governing program management committees (GPMCs) charged with oversight of the project.

h. Appropriate procedures and controls are instituted to ensure that all actions from reviews are followed and verified through implementation to closure.

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